U.S Environmental Protection Agency
Office of Research and Development

National Exposure Research Laboratory
National Center for Computational Toxicology
Research Triangle Park, North Carolina, Headquarters
Athens, Georgia
Cincinnati, Ohio
Las Vegas, Nevada

STANDARD OPERATING PROCEDURE

Title: Sample Collection Protocol for PFCs in Surface and Well Water

Number: EMAB-113.0	Effective Date: 2/12/2009

SOP was Developed ☒ In-house ☐ Extramural

Alternative Identification:

SOP Steward

Name: Andrew B. Lindstrom
Signature: Andrew B. Lindstrom Date: 2/12/09

Approval

Name: Ron Williams
Title: EMAB Branch Chief
Signature: Ron Williams Date: 2/12/09

Concurrence*

Name: ELIZABETH BETZ
Title: QA MANAGER, HEASD
Signature: Elizabeth Betz Date: 2/12/09

For Use by QA Staff Only:

SOP Entered into QATS: EBB (Initials) 2/12/09 (Date)

*** Optional - typically used by project officers for review by QA Manager**

Sample Collection Protocol for PFCs in Surface and Well Water

1. 0 Scope and Application

This protocol outlines the steps to follow when collecting surface and well water samples for the analysis for perfluorinated compounds (PFCs) by ultra-high performance liquid chromatography (UPLC)-tandem mass spectrometry (MS/MS).

2.0 Summary of Method

Surface or well water samples are collected in pre-cleaned 1L high density polyethylene (HDPE Nalgene) bottles. Dilute nitric acid is added at the time of collection for sample preservation. Samples are maintained at ambient temperatures post sampling through laboratory analysis.

3.0 Materials

3.1 Nalgene HDPE bottles, pre cleaned, 1 L size, (EP Scientific Products, Miami, OK)
3.2 Methanol (B&J High Purity, Muskegon, MI)
3.3 Nitric acid, 5 mL ampoules of 35 % , (EP Scientific Products, Miami, OK)
3.4 PFCA-MXA PFC target compound mixture, 5µg/mL (Wellington Laboratories, www.well-labs.com)

4.0 Items Prepared and Supplied to the Field Staff by PFC Team at HEASD

The PFC Team at HEASD will prepare and ship the following items for use by the field staff for the collection of the water samples. Empty pre-cleaned 1-L HDPE (Nalgene) bottles will be prepared and supplied to the field staff ready for sample collection along with premeasured 5 mL ampoules of 35% nitric acid.

Note: The 5 mL of 35% nitric acid is added to the sample as a preservation agent at the time of sample collection.

Five shipping coolers each containing the following materials will be provided for this sampling effort.

- one field blank sample, marked with red tape on the cap;
- one low level trip spike (200 ng/L for all targets), marked with red tape on the cap;

- one high level trip spike (400 ng/L for all targets), marked with red tape on the cap;

Note: samples with red tape on the cap should not be removed from the shipping container or opened for any reason.

- Ten empty bottles to be used for the collection of the water samples;
- Two empty bottles with green tape on the cap to be used for the collection of duplicate samples;
- Twelve ampoules, each containing 5 mL of 35% nitric acid solution, to be used as a preservative for collected samples and 12 orange EP HNO_3 stickers to be placed on each sample bottle to indicate that the preservative has been added.
- One, 1 L wide-mouth polypropylene bottle for use as a primary sample collection vessel, for circumstances where normal bottles cannot be easily filled.
- Return shipping address and RTP contact information.

5.0 Sample Container Preparation

PFC samples are collected in factory pre-cleaned 1 L HDPE (High Density Polyethylene Nalgene) bottles that have been rinsed with methanol at the laboratory before sending to the field. Each bottle is rinsed with 10 mL of methanol, shaken, inverted to drain, and allowed to air dry prior to recapping.

6.0. Preparation of Quality Control Samples

6.1 Quality Control Samples will consist of field blanks, duplicates, and trip spikes (or field controls) that will be included at a rate of 10% of the total number of field samples collected. (Note that trip spikes (field controls) consist of a set of two bottles spiked at different concentrations.)

6.2 Field blanks will prepared in the RTP PFC laboratory by filling pre-cleaned 1 L collection bottles with deionized laboratory grade water, previously determined to be PFC-free. The samples will be preserved with the addition of 5 mL of 35% nitric acid, supplied in premeasured ampoules, with an orange EP HNO_3 sticker placed on the collection bottle to indicate that the preservation agent has been added. The sample will then be tightly capped and mixed well. These bottles will be clearly marked with red tape on the caps indicating that they should not be removed from the shipping container or opened during sampling.

6.3 Trip spikes (or field controls) will be prepared at low (200 ng/L) and high (400 ng/L) levels of all of the compounds on the target list. Preparation will be as follows:

6.3.1 PFCA–MXA standard containing all of the target compounds at 5 µg/mL (= 5 ng/µL) will be purchased from Wellington Laboratories (http://www.well-labs.com/).

6.3.2 To prepare low level QC spikes, 40 µL of this standard will be added to 1 L of deionized laboratory grade water (5 ng/µL x 40 µL = 200 ng/L) and capped and mixed well. The samples will be preserved with the addition of 5 mL of 35% nitric acid, supplied in premeasured ampoules, with an orange EP HNO_3 sticker placed on the collection bottle to indicate that the preservation agent has been added. The sample will then be tightly capped and mixed well.

6.3.3 To prepare high level QC spikes, 80 µL of this standard will be added to 1 L of deionized laboratory grade water (5 ng/µL x 80 µL = 400 ng/L) and capped and mixed well. The samples will be preserved with the addition of 5 mL of 35% nitric acid, supplied in premeasured ampoules, with an orange EP HNO_3 sticker placed on the collection bottle to indicate that the preservation agent has been added. The sample will then be tightly capped and mixed well.

Note: These bottles will be clearly marked with red tape on the caps indicating that they should not be removed from the shipping container or opened during sampling.

6.4 Duplicate surface and well water samples are to be collected using the bottles marked with green tape on the cap. Samples will be collected sequentially from the same source. Approximately half of the duplicates should come from well water sources and half from surface water sources.

7.0 Sample Collection

7.1 For surface water, dip the empty sample bottle directly into the water and rinse the bottle three times with water collected from approximately 15 - 30 cm beneath the water surface. The fourth time, collect the sample from approximately 15 - 30 cm beneath the surface.

7.2 For well water, field personnel should follow the guidelines provided by Region 4 SOP No. SESDPROC-305-1, *Potable Water Supply Sampling* for purging and purge adequacy for the type of source being sampled (Attached). Once the source has been adequately purged, the collection bottle should be rinsed with three volumes of water, and the sample collected on the fourth iteration.

7.3 Duplicate samples should be collected on each day that sampling is performed at a rate of approximately 10% of the water samples. Overall, duplicate samples representing 10% or a minimum of at least three duplicate sample sets; whichever is larger, must be collected during the entire sampling event. Additionally, approximately equal numbers of well and surface water duplicates should be collected.

7.4 In the event that conditions prevent the use of a narrow mouthed sample bottle for the collection of the sample, the wide-mouthed sample bottle can be used as a primary sampler. It must be rinsed with three volumes of the sample water before it can be used to fill the regular narrow mouthed bottles. Also note that the narrow-mouthed sample bottle must also be rinsed with 3 volumes of sample water before a final sample is retained. Use of the wide-mouthed bottle as a primary collection container must be noted on the sample log.

7.5 All sample bottles should only be filled to the top of the cylindrical portion of the bottle, leaving the shoulder and the neck empty to allow room for the preservative to be added.

7.6 Add 5 mL of 35% nitric acid, supplied in the premeasured ampoules, into the sample, cap tightly, place an orange EP HNO_3 sticker onto the water collection bottle to indicate that the preservation agent has been added, and mix well.

Note: Only the contents of the ampoule should be added to the sample – the opened ampoule should not be placed into the sample bottle. Also note that the prefilled blank and spike samples, marked with red tape on the caps, will already contain the nitric acid preservative. These samples should not be removed from the shipping container or opened for any reason.

7.7 Return sample bottles to the original shipping container (coolers) and maintain at ambient temperature. Do not cool.

8.0 Shipping

8.1 Ship to the analytical lab within 72 hours. Samples should be shipped for overnight delivery. Ship at ambient temperatures, no cooling is required. Note that the RTP lab can only receive samples Monday – Friday, during normal working hours. Samples should not be shipped to arrive on Saturday, Sunday, or on Federal holidays.

8.2 **NERL RTP PFC laboratory shipping address is as follows:**

Attn: Mark Strynar and/or Andrew Lindstrom
USEPA Chemical Services Center
109 TW Alexander Drive
Building "E" Loading Dock, Rm. E-178
Durham, NC 27711

9.0 Sample Storage

Store collected samples and QC samples at ambient laboratory temperature in a secured location in the laboratory until analysis. Samples are stable under these conditions for up to 4 weeks.

10.0 Contact Information

Following is the contact information for US EPA NERL PFC laboratory team.

Mark Strynar
(W) 919-541-3706
(Cell) 919-606-6905
Strynar.mark@epa.gov

Andy Lindstrom
919-541-0551
(Cell) 919-302-6635
Lindstrom.andrew@epa.gov

Amy Delinsky
919-541-7858
Delinsky.amy@epa.gov

Attachment:

EPA Region 4's Potable Water Supply Sampling SOP SESDPROC-305-R1

Region 4
U.S. Environmental Protection Agency
Science and Ecosystem Support Division
Athens, Georgia

OPERATING PROCEDURE

Title: **Potable Water Supply Sampling**

Effective Date: November 1, 2007	Number: SESDPROC-305-R1

Authors

Name: Maria Labrador
Title: Environmental Engineer
Signature: [signature] Date: 11/2/07

Approvals

Name: Antonio Quinones
Title: Chief, Environmental Investigations Branch
Signature: [signature] Date: 11/2/07

Name: Laura Ackerman
Title: Field Quality Manager, Science and Ecosystem Support Division
Signature: [signature] Date: 11/01/07

Revision History

This table shows changes to this controlled document over time. The most recent version is presented in the top row of the table. Previous versions of the document are maintained by the SESD Field Quality Manager.

History	Effective Date
SESDPROC-305-R1, *Potable Water Sampling*, replaces SESDPROC-305-R0 **General** Updated referenced operating procedures due to changes in title names and or to reflect most recent version. **Title Page** Changed title for Antonio Quinones from Environmental Investigations Branch to Enforcement and Investigations Branch **Section 1.3** Updated information to reflect that the procedure is located on the H: drive of the LAN. Clarified Field Quality Manager (FQM) responsibilities. **Section 1.4** Alphabetized and revised the referencing style for consistency. **Section 1.5.1** Corrected the title of the Safety, Health, and Environmental Management Program Procedures and Policy Manual.	November 1, 2007
SESDPROC-305-R0, Potable Water Supply Sampling, Original Issue	February 05, 2007

TABLE OF CONTENTS

1 General Information 4

1.1 Purpose 4
1.2 Scope/Application 4
1.3 Documentation/Verification 4
1.4 References 4
1.5 General Precautions 6
1.5.1 Safety 6
1.5.2 Procedural Precautions 6

2 Special Sampling Considerations 8

2.1 Volatile Organic Compounds (VOC) Analysis 8
2.2 Special Precautions for Trace Contaminant Potable Water Supply Sampling 8
2.3 Sample Handling and Preservation Requirements 9
2.4 Quality Control 9
2.5 Records 9

3 Potable Water Supply Sampling – Sample Site Selection 11

3.1 General 11

4 Potable Water Supply Sampling Methods - Purging 13

4.1 General 13
4.1.1 Purging and Purge Adequacy 13
4.2 Potable Water Samples Collected from Wells with In-Place Plumbing 13
4.2.1 Continuously Running Pumps 14
4.2.2 Intermittently or Infrequently Running Pumps 14
4.3 Investigation Derived Waste 14

5 Potable Water Supply Sampling Methods – Sampling 15

5.1 General 15
5.2 Collecting Samples from In-Place Plumbing 15
5.3 Sample Preservation 16
5.4 Special Sample Collection Procedures 16
5.4.1 Trace Organic Compounds and Metals 16
5.4.2 Filtering 16
5.5 Specific Sampling Equipment Quality Assurance Techniques 17
5.6 Auxiliary Data Collection 18

Contents

1 General Information

1.1 Purpose

This document describes general and specific procedures, methods and considerations to be used and observed when collecting potable water supply samples for field screening or laboratory analysis.

1.2 Scope/Application

The procedures contained in this document are to be used by field personnel when collecting and handling potable water supply samples in the field. On the occasion that SESD field personnel determine that any of the procedures described in this section are inappropriate, inadequate or impractical and that another procedure must be used to obtain a potable water supply sample, the variant procedure will be documented in the field log book, along with a description of the circumstances requiring its use.

1.3 Documentation/Verification

This procedure was prepared by persons deemed technically competent by SESD management, based on their knowledge, skills and abilities and has been tested in practice and reviewed in print by a subject matter expert. The official copy of this procedure resides on the H: drive of the SESD local area network. The Field Quality Manager (FQM) is responsible for ensuring the most recent version of the procedure is placed on the H: drive and for maintaining records of review conducted prior to its issuance.

1.4 References

International Air Transport Authority (IATA). Dangerous Goods Regulations. Most Recent Version

Puls, Robert W., and Michael J. Barcelona. Filtration of Ground Water Samples for Metals Analysis. *Hazardous Waste and Hazardous Materials* 6(4): 385-393 (1989).

Puls, Robert W., Don A. Clark, and Bert Bledsoe. Metals in Ground Water: Sampling Artifacts and Reproducibility. *Hazardous Waste and Hazardous Materials* 9(2): 149-162 (1992).

SESD Operating Procedure for Control of Records. SESDPROC-002. Most Recent Version

SESD Operating Procedure for Equipment Inventory and Management, SESDPROC-104, Most Recent Version

SESD Operating Procedure for Field Equipment Cleaning and Decontamination, SESDPROC-205, Most Recent Version

SESD Operating Procedure for Field pH Measurements, SESDPROC-100, Most Recent Version

SESD Operating Procedure for Field Sampling Quality Control, SESDPROC-011, Most Recent Version

SESD Operating Procedure for Field Specific Conductance Measurements, SESDPROC-101, Most Recent Version

SESD Operating Procedure for Field Temperature Measurements, SESDPROC-102, Most Recent Version

SESD Operating Procedure for Field Turbidity Measurements, SESDPROC-103, Most Recent Version

SESD Operating Procedure for Logbooks, SESDPROC-010, Most Recent Version

SESD Operating Procedure for Management of Investigation Derived Waste, SESDPROC-202, Most Recent Version

SESD Operating Procedure for Packaging, Marking, Labeling and Shipping of Environmental and Waste Samples, SESDPROC-209, Most Recent Version

SESD Operating Procedure for Sample and Evidence Management, SESDPROC-005, Most Recent Version

US EPA. 1975. Handbook for Evaluating Water Bacteriological Laboratories. Office of Research and Development (ORD). Municipal Environmental Research Laboratory. Cincinnati, Ohio.

US EPA. 1977. Sampling for Organic Chemicals and Microorganisms in the Subsurface. EPA-600/2-77-176

US EPA. 1978. Microbiological Methods for Monitoring the Environment. Water and Wastes. ORD. Environmental Monitoring and Support Laboratory. Cincinnati, Ohio

US EPA. 1995. Ground Water Sampling - A Workshop Summary. Proceedings from the Dallas, Texas November 30 - December 2, 1993 Workshop. Office of Research and Development Robert S. Kerr Environmental Research Laboratory. EPA/600/R-94/205.

US EPA. 2001. Environmental Investigations Standard Operating Procedures and Quality Assurance Manual. Region 4 Science and Ecosystem Support Division (SESD). Athens. GA

US EPA. Analytical Support Branch Laboratory Operations and Quality Assurance Manual. Region 4 SESD. Athens. GA. Most Recent Version

US EPA. April 13. 1981. Final Regulation Package for Compliance with DOT Regulations in the Shipment of Environmental Laboratory Samples. Memo from David Weitzman. Work Group Chairman. Office of Occupational Health and Safety (PM-273)

US EPA. Safety. Health and Environmental Management Program Procedures and Policy Manual. Region 4 SESD. Athens. GA. Most Recent Version

1.5 General Precautions

1.5.1 Safety

Proper safety precautions must be observed when collecting potable water supply samples. Refer to the SESD Safety. Health and Environmental Management Program (SHEMP) Procedures and Policy Manual and any pertinent site-specific Health and Safety Plans (HASP) for guidelines on safety precautions. These guidelines should be used to complement the judgment of an experienced professional. Address chemicals that pose specific toxicity or safety concerns and follow any other relevant requirements. as appropriate.

1.5.2 Procedural Precautions

The following precautions should be considered when collecting potable water supply samples.

- Special care must be taken not to contaminate samples. This includes storing samples in a secure location to preclude conditions which could alter the properties of the sample. Samples shall be custody sealed during long-term storage or shipment.
- Always sample from the anticipated cleanest. i.e.. least contaminated location. to the most contaminated location. This minimizes the opportunity for cross-contamination to occur during sampling.
- Collected samples must remain in the custody of the sampler or sample custodian until the samples are relinquished to another party.
- If samples are transported by the sampler. they will remain under his/her custody or be secured until they are relinquished.
- Shipped samples shall conform to all U.S. Department of Transportation (DOT) and/or International Air Transportation Association (IATA) hazardous materials shipping requirements.

- Documentation of field sampling is done in a bound logbook.
- Chain-of-custody documents shall be filled out and remain with the samples until custody is relinquished.
- All shipping documents, such as air bills, bills of lading, etc., shall be retained by the project leader and stored in a secure place.

2 Special Sampling Considerations

2.1 Volatile Organic Compounds (VOC) Analysis

Potable water supply samples for VOC analysis must be collected in 40 ml glass vials with Teflon® septa. The vials may be either preserved with concentrated hydrochloric acid or they may be unpreserved. Preserved samples have a two week holding time, whereas unpreserved samples have only a seven day holding time. In the great majority of cases, the preserved vials are used to take advantage of the extended holding time. In some situations however, it may be necessary to use the unpreserved vials. For example, if the potable water supply has a high amount of dissolved limestone, i.e., is highly calcareous, there will most likely be an effervescent reaction between the hydrochloric acid and the water, producing large numbers of fine bubbles. This will render the sample unacceptable. In this case, unpreserved vials should be used and arrangements must be confirmed with the laboratory to ensure that they can accept the unpreserved vials and meet the shorter sample holding times.

The samples should be collected with as little agitation or disturbance as possible. The vial should be filled so that there is a meniscus at the top of the vial and absolutely no bubbles or headspace should be present in the vial after it is capped. After the cap is securely tightened, the vial should be inverted and tapped on the palm of one hand to see if any undetected bubbles are dislodged. If a bubble or bubbles are present, the vial should be topped off using a minimal amount of sample to re-establish the meniscus. Care should be taken not to flush any preservative out of the vial during topping off. If, after topping off and capping the vial, bubbles are still present, a new vial should be obtained and the sample re-collected.

2.2 Special Precautions for Trace Contaminant Potable Water Supply Sampling

- A clean pair of new, non-powdered, disposable gloves will be worn each time a different location is sampled and the gloves should be donned immediately prior to sampling. The gloves should not come in contact with the media being sampled and should be changed any time during sample collection when their cleanliness is compromised.
- Sample containers for samples suspected of containing high concentrations of contaminants shall be stored separately.
- Sample collection activities shall proceed progressively from the least suspected contaminated area to the most suspected contaminated area if sampling devices are to be reused. Samples of waste or highly contaminated media must not be placed in the same ice chest as environmental (i.e., containing low contaminant levels) or background samples.
- If possible, one member of the field sampling team should take all the notes and photographs, fill out tags, etc., while the other members collect the samples.
- Samplers must use new, verified certified-clean disposable or non-disposable equipment cleaned according to procedures contained in SESD Operating

Procedure for Field Equipment Cleaning and Decontamination (SESDPROC-205) for collection of samples for trace metals or organic compound analyses.

2.3 Sample Handling and Preservation Requirements

The following procedures should be followed when collecting samples from potable water supplies:

1. Potable water supply samples will typically be collected from a tap or spigot located at or near the well head or pump house and before the water supply is introduced into any storage tanks or treatment units. Efforts should be made to reduce the flow from either the tap or spigot during sample collection to minimize sample agitation.
2. During sample collection, make sure that the tap or spigot does not contact the sample container.
3. Place the sample into appropriate, labeled containers. Samples collected for VOC analysis must not have any headspace (see Section 2.1, Volatile Organic Compound Analysis). All other sample containers must be filled with an allowance for ullage.
4. All samples requiring preservation must be preserved as soon as practically possible, ideally immediately at the time of sample collection. If preserved VOC vials are used, these will be preserved with concentrated hydrochloric acid by Analytical Support Branch (ASB) personnel prior to departure for the field investigation. All other chemical preservatives required for the remaining suite of analytes will be supplied by ASB personnel and will be added to the samples by SESD field personnel or other authorized persons. The adequacy of sample preservation will be checked after the addition of the preservative for all samples except for the samples collected for VOC analysis. Additional preservative should be added to achieve adequate preservation. Preservation requirements for groundwater samples are found in the USEPA Region 4 Analytical Support Branch Laboratory Operations and Quality Assurance Manual (ASBLOQAM), Most Recent Version

2.4 Quality Control

Equipment blanks should be collected if equipment is field cleaned and re-used on-site or if necessary to document that low-level contaminants were not introduced by any sampling equipment.

2.5 Records

Information generated or obtained by SESD personnel will be organized and accounted for in accordance with SESD records management procedures found in the SESD Operating Procedure for Control of Records (SESDPROC-002). Field notes, recorded in a bound field logbook, will be generated, as well as chain-of-custody documentation in

accordance with the SESD Operating Procedure for Sample and Evidence Management (SESDPROC-005) and SESD Operating Procedure Logbooks (SESDPROC-010).

3 Potable Water Supply Sampling – Sample Site Selection

3.1 General

The following should be considered when choosing the location to collect a potable water sample:

- Taps selected for sample collection should be supplied with water from a service pipe connected directly to a water main in the segment of interest.
- Whenever possible, choose the tap closest to the water source, and prior to the water lines entering the residence, office, building, etc., and also prior to any holding or pressurization tanks.
- The sampling tap must be protected from exterior contamination associated with being too close to a sink bottom or to the ground. Contaminated water or soil from the faucet exterior may enter the bottle during the collection procedure since it is difficult to place a bottle under a low tap without grazing the neck interior against the outside faucet surface. If the tap is too close to the ground for direct collection into the appropriate container, it is acceptable to use a smaller container to transfer sample to a larger container. The smaller container should be made of glass or stainless steel, and should be decontaminated to the same standards as the larger container.
- Leaking taps that allow water to discharge from around the valve stem handle and down the outside of the faucet, or taps in which water tends to run up on the outside of the lip, are to be avoided as sampling locations.
- Disconnect any hoses, filters, or aerators attached to the tap before sampling. These devices can harbor a bacterial population if they are not routinely cleaned or replaced when worn or cracked.
- Taps where the water flow is not constant should be avoided because temporary fluctuation in line pressure may cause clumps of microbial growth that are lodged in a pipe section or faucet connection to break loose. A smooth flowing water stream at moderate pressure without splashing should be used. The sample should be collected without changing the water flow. It may be appropriate to reduce the flow for the volatile organic compounds aliquot to minimize sample agitation.

Occasionally, samples are collected to determine the contribution of system-related variables (e.g., transmission pipes, water coolers, water heaters, holding tanks, pressurization tanks, etc.) to the quality of potable water supplies. In these cases, it may be necessary to ensure that the water source has not been used for a specific time interval (e.g., over a weekend or a three- or four-day holiday period). Sample collection may consist of collecting a sample of the initial flush, collecting a sample after several

minutes, and collecting another sample after the system being investigated has been completely purged.

When sampling for bacterial content, the sample container should not be rinsed before use due to possible contamination of the sample container or removal of the thiosulfate dechlorinating agent (if used). When filling any sample container, care should be taken that splashing drops of water from the ground or sink do not enter into either the bottle or cap.

When sampling at a water treatment plant, samples are often collected from the raw water supply and the treated water after chlorination.

Obtain the name(s) of the resident or water supply owner/operator, the resident's exact mailing address, and the resident's home and work telephone numbers. The information is required so that the residents or water supply owner/operators can be informed of the results of the sampling program.

4 Potable Water Supply Sampling Methods - Purging

4.1 General

4.1.1 Purging and Purge Adequacy

Purging is the process of removing stagnant water immediately prior to sampling. In order to determine when an adequate purge has occurred, field investigators should monitor the pH, specific conductance, temperature, and turbidity of the water removed during purging. For potable water supply sampling it is recommended to purge the system for at least 15 minutes when possible.

An adequate purge is achieved when the pH, specific conductance, and temperature of the potable water have stabilized and the turbidity has either stabilized or is below 10 Nephelometric Turbidity Units (NTUs) (twice the Primary Drinking Water Standard of 5 NTUs). Although 10 NTUs is normally considered the minimum goal for most water sampling objectives, lower turbidity has been shown to be easily achievable in most situations and reasonable attempts should be made to achieve these lower levels. Stabilization occurs when, for at least three consecutive measurements, the pH remains constant within 0.1 Standard Unit (SU), specific conductance varies no more than approximately 10 percent, and the temperature is constant. There are no set criteria establishing how many total sets of measurements are adequate to document stability of parameters.

If, after 15 minutes, the in situ chemical parameters have not stabilized according to the above criteria, additional water can be removed. If the parameters have not stabilized after 15 minutes, it is at the discretion of the project leader whether or not to collect a sample or to continue purging.

4.2 Potable Water Samples Collected from Wells with In-Place Plumbing

Wells with in-place plumbing are commonly found at municipal water treatment plants, industrial water supplies, private residences, etc. The objective of purging wells with in-place pumps is the same as with monitoring wells without in-place pumps, i.e., to ultimately collect a water sample representative of aquifer conditions. Among the types of wells identified in this section, two different approaches are necessary.

A permanent well with an in-place pump should, in all respects, be treated like a well without a pump. One limitation is that in most cases the in-place pump is 'hard' mounted, that is, the pump is suspended in the well at a pre-selected depth and cannot be moved up or down during purging and sampling. In these cases, well volumes are removed, parameters are measured and the well is sampled from the pump discharge, after volume removal and parameter conditions have been met.

In the case of the other types of wells, i.e., municipal, industrial and residential supply wells, however, not enough is generally known about the construction aspects of the wells to apply the same criteria as used for monitoring wells, i.e., 3 to 5 well volumes. The volume to be purged in these situations, therefore, depends on several factors: whether the pumps are running continuously or intermittently and whether or not any storage/pressure tanks are located between the sampling point and the pump. The following considerations and procedures should be followed when purging wells with in-place plumbing under the conditions described.

4.2.1 Continuously Running Pumps

If the pump runs more or less continuously, no purge (other than opening a valve and allowing it to flush for a few minutes) is necessary. If a storage tank is present, a spigot, valve or other sampling point should be located between the pump and the storage tank. If not, locate the valve closest to the tank. Measurements of pH, specific conductance, temperature, and turbidity are recorded at the time of sampling.

4.2.2 Intermittently or Infrequently Running Pumps

If the pump runs intermittently or infrequently, best judgment should be utilized to remove enough water from the plumbing to flush standing water from the piping and any storage tanks that might be present. Generally, under these conditions, 15 to 30 minutes will be adequate. Measurements of pH, specific conductance, temperature and turbidity should be made and recorded at intervals during the purge and the final measurements made at the time of sampling should be considered the measurements of record for the event.

4.3 Investigation Derived Waste

Purging generates quantities of purge water or investigation derived waste (IDW), the disposition of which must be considered. See SESD Operating Procedure for Management of Investigation Derived Waste (SESDPROC-202) for guidance on management or disposal of this waste.

5 Potable Water Supply Sampling Methods – Sampling

5.1 General

Sampling is the process of obtaining, containerizing, and preserving (if required) a potable water supply water sample after the purging process is complete. It is recognized that there are situations, such as industrial or municipal supply wells or private residential wells, where a well may be equipped with a dedicated pump from which a sample would not normally be collected. Discretion should always be used in obtaining a sample.

5.2 Collecting Samples from In-Place Plumbing

Samples should be collected following purging from a valve or cold water tap as near to the well as possible, preferably prior to any storage/pressure tanks or physical/chemical treatment system that might be present. Remove any hose that may be present before sample collection and reduce the flow to a low level to minimize sample disturbance, particularly with respect to volatile organic constituents. Samples should be collected directly into the appropriate containers (see the ASBLOQAM for a list of containers). It may be necessary to use a secondary container, such as a clean 8 oz. or similar size sample jar or a stainless steel scoop, to obtain and transfer samples from spigots with low ground clearance. All measurements for pH, specific conductance, temperature, and turbidity should be recorded at the time of sample collection.

1. Ideally, the sample should be collected from a tap or spigot located at or near the well head or pump house and before the water supply is introduced into any storage tanks or treatment units. If the sample must be collected at a point in the water line beyond pressurization or holding tank, a sufficient volume of water should be purged to provide a complete exchange of fresh water into the tank and at the location where the sample is collected. If the sample is collected from a tap or spigot located just before a storage tank, spigots located inside the building or structure should be turned on to prevent any backflow from the storage tank to the sample tap or spigot. It is generally advisable to open several taps during the purge to ensure a rapid and complete exchange of water in the tanks.

2. Purge the system for at least 15 minutes when possible. During the purge period, obtain at least three sets of readings as follows: after purging for several minutes, measure the pH, specific conductivity, temperature and turbidity of the water. Continue to measure these parameters to assess for stabilization.

3. After three sets of readings have been obtained, samples may be collected. If stabilization has not occurred after the 15-minute purge period, it is at the discretion of the project leader to collect the sample or continue purging and monitoring the parameters. This would depend on the condition of the system and the specific objectives of the investigation.

5.3 Sample Preservation

After sample collection, all samples requiring preservation must be preserved as soon as practical. Consult the ASBLOQAM for the correct preservative for the particular analytes of interest. All samples preserved using a pH adjustment (except VOCs) must be checked, using pH strips, to ensure that they were adequately preserved. This is done by pouring a small volume of sample over the strip. Do not place the strip in the sample. Samples requiring reduced temperature storage should be placed on ice immediately.

5.4 Special Sample Collection Procedures

5.4.1 Trace Organic Compounds and Metals

Special sample handling procedures should be instituted when trace contaminant samples are being collected. All sampling equipment which comes into contact with the water must be cleaned in accordance with the cleaning procedures described in SESD Operating Procedure for Field Equipment Cleaning and Decontamination, (SESDPROC-205).

5.4.2 Filtering

As a standard practice, potable water samples will not be filtered for routine analysis. Filtering will usually only be performed to determine the fraction of major ions and trace metals passing the filter and used for flow system analysis and for the purpose of geochemical speciation modeling. Filtration is not allowed to correct for improperly designed or constructed wells, inappropriate sampling methods, or poor sampling technique.

When samples are collected for routine analyses and are filtered, both filtered and non-filtered samples will be submitted for analyses. Samples for organic compounds analysis should not be filtered. Prior to filtration of the water sample for any reason other than geochemical speciation modeling, the following criteria must be demonstrated to justify the use of filtered samples for inorganic analysis:

1. The water samples were collected using sampling techniques in accordance with this section, and the water samples were analyzed in accordance with USEPA approved methods.

2. Efforts have been undertaken to minimize any persistent sample turbidity problems.

3. Turbidity measurements should be taken during purging and sampling to demonstrate stabilization or lack thereof. These measurements should be documented in the field notes. If the water sample appears to have either a chemically-induced elevated turbidity, such as would occur with precipitate

formation, or a naturally elevated colloid or fine, particulate-related turbidity, filtration will not be allowed.

If filtration is necessary for purposes of geochemical modeling or other pre-approved cases, the following procedures are suggested:

1. Accomplish in-line filtration through the use of disposable, high capacity filter cartridges (barrel-type) or membrane filters in an in-line filter apparatus. The high capacity, barrel-type filter is preferred due to the higher surface area associated with this configuration. If a membrane filter is utilized, a minimum diameter of 142 mm is suggested.

2. Use a 5 µm pore-size filter for the purpose of determining the colloidal constituent concentrations. A 0.1 µm pore-size filter should be used to remove most non-dissolved particles.

3. Rinse the cartridge or barrel-type filter with 500 milliliters of the solute (potable water to be sampled) prior to collection of sample. If a membrane filter is used, rinse with 100 milliliters of solute prior to sample collection.

Potential differences could result from variations in filtration procedures used to process water samples for the determination of trace element concentrations. A number of factors associated with filtration can substantially alter "dissolved" trace element concentrations; these include filter pore size, filter type, filter diameter, filtration method, volume of sample processed, suspended sediment concentration, suspended sediment grain-size distribution, concentration of colloids and colloidal-associated trace elements, and concentration of organic matter. Therefore, consistency is critical in the comparison of short-term and long-term results. Further guidance on filtration may be obtained from the following: 1) Metals in Ground Water: Sampling Artifacts and Reproducibility; 2) Filtration of Ground Water Samples for Metals Analysis; and 3) Ground Water Sampling - A Workshop Summary

Bacterial Sampling

Whenever wells (normally potable wells) are sampled for bacteriological parameters, care must be taken to ensure the sterility of all sampling equipment and all other equipment entering the well. Further information regarding bacteriological sampling is available in the following: 1) Sampling for Organic Chemicals and Microorganisms in the Subsurface; 2) Handbook for Evaluating Water Bacteriological Laboratories; and 3) Microbiological Methods for Monitoring the Environment, Water and Wastes.

5.5 Specific Sampling Equipment Quality Assurance Techniques

All equipment used to collect potable water samples shall be cleaned as outlined in the SESD Operating Procedure for Field Equipment Cleaning and Decontamination

(SESDPROC-205) and repaired, if necessary, before being stored at the conclusion of field studies. Cleaning procedures utilized in the field or field repairs shall be thoroughly documented in field records.

5.6 Auxiliary Data Collection

During potable water sample collection, it may be necessary to record additional sampling data, such as flow rates, etc. This information should be documented in the field records.